Effects of revenue use and perceived effectiveness on acceptability of transport pricing policies

Geertje Schuitema & Linda Steg

University of Groningen, Departement of Psychology,
Grote Kruisstraat 2/1, 9712 TS Groningen, The Netherlands
g.schuitema@ppsw.rug.nl

Paper presented at:
45th Congress of the European Regional Science Association
Free University, Amsterdam
August 23-27 2005

This research was carried out within the NWO/Connekt VEV project "A Multidisciplinary Study of Pricing Policies in Transport"; nr. 014-34-351, see http://www.feweb.vu.nl/md-pit/

1. Introduction

Worldwide, car traffic has increased rapidly during the last decades. Between 1950 and 1990, the amount of motorised traffic cars has increased from 75 million to 675 million. This implies that during this period, motorised traffic has multiplied 9 times. 80% motorised traffic involves private transportation (OECD, 1996). It is likely that the number of kilometres driven per person as well as car ownership will increase further in the future (OECD, 1996).

Increased traffic and transport results in many positive effects. For example, traffic and transport facilitates economic activities. Furthermore, it facilitates activities of citizens. Motorised transport provides individuals the opportunity to be flexible, and visit activities at many different places. However, mobility also results in negative effects. First, increasing car use threatens the accessibility of locations. Congestion is especially a problem in densely populated areas. Second, it threatens environmental qualities, e.g., due to emission of CO_2 and particles. Third, increasing car use may result in a reduction of quality of life, especially in cities, due to e.g., traffic safety, sound pollution, local air pollution, and parking problems.

Various policy measures may be implemented to reduce the problems caused by car use. Some do not necessitate a reduction in car use (e.g., increased capacity of road infrastructure, improved car technology, or limiting speed); they typically reduce the environmental impact per car. Other measures are aimed at changing car use with respect to when and where people drive, particularly on major commuter arteries during peak hours and in city centres. Since the proposed measures focus on changing or reducing demand for car use, they are generally referred to as *travel demand management* (TDM) measures (Kitamura, Fujii, & Pas, 1997).

A large number of TDM measures have been proposed and (sometimes) implemented with the aim of reducing car use. In general, four types of TDM measures may be distinguished (Steg, 2003). First, provision of physical alternatives and physical changes. Examples are improving public transport and constructing new road infrastructure. Second, legal policies, for instance, prohibition of car use in city centres. Third, economic policies such as kilometre charges and congestion pricing. Fourth, information and education strategies, for instance, information campaigns or social marketing.

Many people belief that especially economic strategies may be effective in reducing problems of car use. However, public support for transport pricing measures is generally low (e.g., Steg, 2003; Schade & Schlag, 2000). Public support is an important precondition for implementing policies that restrict individual car use, such as transport pricing (Schlag & Teubel, 1997; Steg, 2003).

In this paper, we discuss two types of factors that may affect the acceptability of pricing policies aimed to change transport behaviour. First, acceptability may depend on characteristics of pricing policies, i.e., the way policies are designed. Several policy characteristics may be relevant, such as price level, the extent of differentiation, and how and when people have to pay. In this paper we focus on a characteristic that appears to strongly affect the acceptability of pricing policies: the allocation of revenues (Verhoef, 1996; Jones, 2003). Second, the perceived effectiveness of pricing policies may affect the extent to which they are acceptable. If people expect policies to actually solve problems of car use, for instance less traffic jams, they may evaluate pricing policies as more acceptable than if they expect the measures not to be effective. If people believe measures to be ineffective, they will be confronted with negative effects of the measure (e.g., higher transport prices), while at the same time collective problems are not being solved. At the same time, transport pricing measures that seriously affect people's freedom to move will not be very acceptable (e.g., Jakobsson, Fujii, & Gärling, 2000). The relationships between perceived effectiveness and acceptability of transport pricing will be elaborated below.

Relationship between revenue use and acceptability of transport pricing

In general, studies on relationships between revenue use and acceptability of pricing policies examined public attitudes towards several types of revenue use. These studies revealed that policies are generally more acceptable if revenues are used in a way that benefits users personally (Harrington, Krupnick, & Alberini, 2001; Verhoef, 1996; Jones, 1991; Schade & Schlag, 2000; CfIT, 2000). Pricing policies appear to be most acceptable if revenues are invested in the transport system, e.g., by reducing taxes related to car ownership and car use (Harrington et al., 2001; Verhoef, 1996; Schade & Schlag, 2000; CfIT, 2000) or by improving public transport (CfIT, 2000; Schade & Schlag, 2000). If revenues are allocated outside the transport domain, such as allocating revenues to general public funds, transport pricing policies are evaluated as

rather unacceptable (Schade & Schlag, 2000; Verhoef, 1996). Similar results were found in a study on the acceptability of pricing policies to reduce energy use, which revealed that policies are evaluated as more acceptable if revenues meet people's interests directly, rather than allocating revenues to general public funds. In fact, price increases of products using a lot of energy were evaluated as acceptable as price decreases of products using little energy, provided that revenues were spent in a way that would further simulate energy savings (Steg, Dreijerink, & Abrahamse, 2006).

Thus, in general people evaluate pricing policies as more acceptable if individuals themselves rather than the general public benefit from the way revenues are allocated. Revenues of transport pricing policies may be returned to car users either by reducing car related taxes or improving road infrastructure. Allocating revenues to general public funds typically involves reducing general taxes that are not related to car use.

If revenues are 'returned to the payer', policies are probably perceived to be more fair, and less restrictive because car users actually see they get something in return (cf. Jakobsson et al., 2000). Most people will probably perceive allocating revenues of transport pricing to reduce general taxes as a loss, because the link between paying for car use and receiving this money back via other taxes is rather indirect. If revenues of transport pricing policies are returned to car users, e.g., by reducing car related taxes, the link between paying and receiving something in return is probably more clear to people. Consequently, people may perceive that they will loose less than if revenues are allocated to general public funds. Based on this, it is hypothesized that transport pricing policies are more acceptable if revenues are returned to the car user rather than to the general public.

Relationship between perceived effectiveness of pricing policies and acceptability

It is rather difficult to predict actual effects of pricing policies. Despite these difficulties, most people have opinions and expectancies about the effects of transport pricing policies. In general, people do not expect pricing policies to be very effective in changing their own car use (e.g., Jakobsson et al., 2000; Schlag & Teubel, 1997; Steg, 1996), congestion, and environmental problems (Rienstra, Rietveld, & Verhoef, 1999). People do expect pricing policies to be more effective in changing car use of others in comparison to their own car use, but they expect the effect on others car use still to be low (Steg, 1996).

Research has shown that acceptability of transport pricing policies is related to the perceived effectiveness of these measures in reducing problems caused by car use (e.g., Rienstra et al., 1999; Bartley, 1995; Schade & Schlag, 2003). These studies revealed that the more people expect a pricing policy to be effective in solving problems (i.e., congestion), the more acceptable they are. Actual effectiveness of transport pricing appeared to be related to acceptability judgements as well. For example the acceptability of a toll ring around Oslo increased *after* the measure was implemented (Tretvik, 2003; Odeck & Bråthen, 2002). However, acceptability did not increase after the implementation of a toll ring in Stuttgart (Schlag & Teubel, 1997). An explanation may be the fact that people in Oslo experienced advantages of the toll ring: congestion decreased. In Stuttgart, congestion levels were not reduced after the implementation of the toll ring. Thus, it may be expected that transport pricing policies are more acceptable if people think they are effective in reducing transport problems.

On the other hand, pricing policies may be more acceptable if they are not too effective in reducing one's own car use, because people do not want to be restricted in their freedom to move. Pricing policies that are effective in reducing transport problems, such as congestion and environmental problems, are also likely to affect one's own car use.

In this paper, we examine whether the perceived effects of transport pricing measures on collective problems and on one's own situation affects the acceptability of these measures. In addition, it is examined if the perceived effects of one's own situation moderate the relationship between the perceived effects of pricing policies and the acceptability. That is, perceived effects of transport pricing measures on collective problems may be related to acceptability only when the transport pricing measure does not seriously affect one's own situation. This implies that the relationship between perceived effects on collective problems and acceptability may be dependent on the extent to which the measure would affect one's own situation.

2. Method

Sample

512 Dutch car users completed a computerized questionnaire via the Internet. Respondents were selected from a telepanel of a Dutch marketing research institute called TNS NIPO (Dutch Institute for Public Opinion and Market Research). Respondents filled out the questionnaire at their computer at home.

The sample consisted of 263 respondents who regularly experienced congestion. These respondents were (on average) spending at least twice a week 10 minutes or more in a traffic jam when travelling in the morning to work by car. This group is labelled 'congestion drivers'. The other 249 car owners were randomly selected from the total panel, which is a representative sample of the Dutch population. This group is labelled 'car users'. The mean age of the full sample was 42 years (SD = 13.2), 61% was male, and 39% was female. 45% of the respondents finished lower education, 29% finished middle education, and 8% finished higher education. For 18% the finished education level was unknown. The average gross income per year was classified into 4 classes: less than €28.500 a year (19% of the respondents), between €28.500 and €45.000 (30%), between €45.000 and €68.000 (27%), and more than €68.000 (15%). For 9% of the respondents data on income level is missing. Almost 22% of the respondents were single, 2% was single with children, 31% had a partner but no children and 45% had a partner and children.

The sample of car users was representative for the Dutch population (Centraal Bureau voor de Statistiek (CBS), 2005), although the average age in this sample is a bit higher. In this sample, average age was 45 years whereas the average age of the Dutch population is 39 years. This is due to the fact that the sample consisted of car users, i.e., minimum age is 18. The sample of congestion drives comprised more male respondents, with a higher income and education level (see also *Table 1*). This is comparable with other samples of car users who are often confronted with traffic jams (Bureau Goudappel Coffeng, 1997; Steg, 2005).

Table 1. Sex, age, income, education level and household type for the total sample and for both sub-samples: car users and congestion drivers

		Car users (N= 249)	Congestion drivers (N = 263)	Total (N = 512)
Sex	male	49%	72.5	61%
	female	51%	27.5	39%
Age (M)		45	39	42
Income	< 28,000	22%	16%	19%
	28,500 – 45,000	28%	31%	30%
	45,000 - 68,000	20%	34%	27%
	> 68,000	10%	19%	15%
	unknown	19%	-	9%
Education level	lower	57%	34%	45%
	middle	22%	36%	29%
	higher	5%	11%	8%
	unknown	16%	20%	18%
Household type	single	18%	26%	22%
	single + children	1%	3%	2%
	partner, no children	33%	30%	31%
	partner and children	49%	41%	45%

Questionnaire

Data presented in this paper was part of a larger questionnaire study aimed to examine the effectiveness and acceptability of transport pricing policies. We focus on parts of the questionnaire that are relevant for the presented paper. Respondents judged two types of kilometre charges: a flat and a variable kilometre charge. For both kilometre charges, various versions were constructed, which systematically varied on two relevant policy characteristics: revenue use and price level. In other words, we followed a 2 (type of kilometre charge) by 2 (revenue use) by 3 (price level) design (see also *Table 2*). Each respondent judged both policies, therefore policy type was a within subject factor. Revenue use and price level were systematically varied between respondents, therefore these were between subject factors. Below, we will describe both kilometre charges in more detail.

Measure 1 – flat kilometre charge

A kilometre charge was described, in which every car user had to pay for each kilometre driven by car (see *Table 2).* Price level was systematically varied. For each kilometre driven by car either 3, 6, or 12 eurocents had to be paid. The way revenues were used was also varied systematically: revenues were either used to decrease income taxes or returned to the car user by abolishing road taxes (if price level was 3 cent), by abolishing road taxes as well as taxes on the purchase of cars (if price level was 6 cent), or by abolishing both these taxes and improving existing

and build new infrastructure (if price level was 12 cent). In case revenues were returned to car users, revenue use type was chosen in such a way that the policy would be budget-neutral for an average Dutch household. The amount of money that respondents would receive back by abolishing road taxes and/ or taxes on the purchase of cars was estimated on basis of fuel type and weight of the car the respondent usually drove (see also Appendix). Based on their individual car use, i.e., yearly kilometrage of the respondent personally, financial consequences for each respondent were estimated. Both costs of the kilometre charge and profits from revenue use, in case revenues were used to decrease car related taxes, were show, as well as total changes in travel cost if the kilometre charge was implemented. Total costs for respondents could increase or decrease, dependent on the number of kilometres they actually drove and revenue use.

Measure 2 – variable kilometre charge

Second, a time-dependent kilometre charge was judged (see *Table 2).* During rush hours (7.00 – 9.00 a.m. and 5.00- 7.00 p.m.), people had to pay a higher fee than on non-rush hours. Again, price level and revenue use were varied systematically. Price levels were either low, people had to pay 6 cent per kilometre during rush hours and 2 cents per kilometre during remaining hours. Average price levels meant that people had to pay 12 cent per kilometre during rush hours and 4 cents per kilometre outside rush hours. High fees implied that people had to pay 24 cents per kilometre during rush hours and 8 cents per kilometre during non-rush hours. Identical to the first measure, revenues were used to decrease income tax or returned to the car user, via abolishing road taxes (lowest price level), abolishing road taxes as well as taxes on purchasing cars (middle price level), or abolishing both these taxes as well as improving and building road infrastructure (highest price level). Again, the kilometre charge was budget neutral for an average Dutch household. As with the first measure, total costs for respondents were estimated and shown, based on their current travel behaviour.

Table 2. Two kilometre charges that were evaluated by respondents

		Flat kilometre charge	**Variable kilometre charge** rush hours 7.00– 9.00 a.m, 5.00–7.00 p.m.	non-rush hours	
		Revenue use			Revenue use
Price level (cents\km)	3	decrease income tax	6	2	Decrease income tax
	3	abolish road taxes	6	2	Abolish road taxes
	6	decrease income tax	12	4	decrease income tax
	6	abolish road taxes and tax on purchase of cars	12	4	Abolish road taxes and tax on purchase of cars
	12	decrease income tax	24	8	decrease income tax
	12	abolish road taxes, tax on purchase of cars, and improve and build road infrastructure	24	8	Abolish road taxes, tax on purchase of cars, and improve and build road infrastructure

In this paper we will focus only on the effect of revenue use, i.e., spending the revenue use on decreasing income taxes versus returning them to car users, on the acceptability of the measures

Judgments of the measures

Each respondent rated one version of the kilometre charges. The versions were randomly allocated to respondents. The financial consequences of the kilometre charges for respondents were estimated, based on their current travel behaviour and type. The actual changes in travel costs were indicated as "you profit" a certain amount (if tax decreases are larger than kilometre charge), or as a loss "you loose" a certain amount (if tax decreases are smaller than kilometre charge).

For each measure, respondents indicated whether they thought the measures would be effective on a seven-point scale (1 -very unlikely- to 7 -very likely-). First, they indicated the perceived effects on congestion levels: "how likely is it that congestion levels decrease if this measure is implemented?" ($\underline{M}_{\text{flat km charge}} = 2.2$; $\underline{M}_{\text{variable km charge}} = 2.7$). Second, they rated the effects on environmental quality: "how likely is it that environmental problems will decrease if this measure is implemented?" ($\underline{M}_{\text{flat km charge}} = 2.3$; $\underline{M}_{\text{variable km charge}} = 2.4$). It appeared that for both kilometre charges, the perceived effects on congestion and environmental problems were strongly correlated (flat kilometre charge: $\alpha = .87$; variable kilometre charge: $\alpha = .89$). Therefore, for each kilometre charge, mean scores on both questions were computed. The mean score on

'perceived effects on collective problems' could range from 1 –very unlikely- to 7 -very likely- that collective problems will decrease if the kilometre charge is implemented. Third, respondents indicated how the measure would affect their own situation: "if you consider all pros and cons of the measure, would you be better or worse off if this measure is implemented?" This question was included after the questions on effects on collective problems, to ensure that respondents would weight individual and collective costs and benefits. Responses were given on a seven-point scale (1 -much worse off- to 7 -much better off-; ($\underline{M}_{\text{flat km charge}} = 2.6$; $\underline{M}_{\text{variable km charge}} = 2.6$).

Finally, respondents indicated how acceptable the measure was to them "how acceptable do you think this measure is?" on a seven-point scale (1 -very unacceptable- to 7 -very acceptable-; ($\underline{M}_{\text{flat km charge}} = 3.0$; $\underline{M}_{\text{variable km charge}} = 2.7$).

3. Results

Relationship between revenue use and acceptability

An ANOVA revealed that respondents evaluated the flat kilometre charge as more acceptable if revenues are returned to car users rather than if the revenues are returned to the general public by decreasing income taxes ($F(1,510) = 22.7$, $p < .001$). In contrast to our expectations, the acceptability of the variable kilometre charge was not related to revenue use ($F(1,510) = 1.8$, p= n.s.). When controlling for actual changes in travel costs, similar results were found: revenue use does affect the acceptability of the flat kilometre charge ($F(1,509) = 12.4$, $p < .001$), but not the acceptability of the variable kilometre charge ($F(1,509) = 1.1$, p= n.s).

Relationship between perceived effectiveness and acceptability

To examine relationships between perceived effectiveness and the acceptability of the kilometre charges, correlations coefficients were calculated (see *Table 3*). The correlation matrix reveals that for both measures, acceptability was positively related to perceived effects on collective problems, own situation, and changes in travel costs as assessed by the researchers. Respondents evaluated the kilometre charges as more acceptable if they thought they are effective in reducing collective problems. These results are in line with previous studies: measures are more acceptable if people think

these measures help reducing problems resulting from car use. Furthermore, in line with our expectations, people thought the kilometre charges were more acceptable if they thought the measures would not have negative effects for them personally. This also emerges from the positive correlation between acceptability and actual changes in travel costs resulting from the kilometre charges: the measures are more acceptable if travel costs would decrease.

The positive correlation between perceived effects on collective problems and perceived effect on one's situation in general indicate that, in general, respondents assume that their situation will improve if collective problems reduce.

Finally, actual changes in travel costs did not correlate significantly with perceived effects on collective problems, but did correlate with the perceived effect of the kilometre charges on one's own situation as well as with the acceptability of the measures. This implies that people expect to be better off and evaluate the measure as more acceptable if their travel costs decrease rather than increase. Interestingly, acceptability appears to correlate less strongly with actual changes in travel costs than with perceived effects of the measures on collective problems. This suggests that acceptability of the kilometre charges may depend more strongly on the perceived effects of the measures on collective problems than on personal financial consequences of the measure. The weak correlation between actual changes in travel costs and perceived effects of the measures on one's own situation is interesting in the light of the strong correlation between expected effects on one's general situation and acceptability of the kilometre charges. This may indicate that changes in collective problems may be more strongly related to changes in one's general situation than are financial consequences.

Table 3. Correlations between acceptability and perceived effects of kilometre charges on collective problems, own situation, and actual travel costs

	Acceptability	Collective problems	Own situation
Collective problems	.31** .43**		
Own situation	.71** .68**	.18** .24**	
Actual changes in travel costs	.22** .18**	-.08 .06	.28** .22**

Note 1: *The upper correlation refers to the flat kilometre charge; the lower correlation refers to the variable kilometre charge*

Note 2: ** p< .001

We examined to what extent both perceived effects of the kilometre charges on collective problems and on one's own situation are related to acceptability judgements via regression analyses. Further, it was examined if the relationship between perceived effects of kilometre charges on collective problems and acceptability was moderated by the perceived effects of the measure on one's own situation.

A regression analyses revealed a main effect of the perceived effects on collective problems and one's own situation. Together they explained 54% of the variance of acceptability of the flat kilometre charge ($F(4, 508) = 201.6$, $p < .001$). Both main effects are independent, which implies that the perceived effects on collective problems as well as the perceived effects on one's own situation determine the acceptability of the flat kilometre charge. The perceived effectiveness of one's own situation did not moderate the relationship between the perceived effectiveness of collective problems and acceptability of the flat kilometre charge.

Similar results were found for the variable kilometre charge: acceptability was determined by the perceived effects on collective problems and on one's own situation ($F(4, 508) = 194.7$, $p < .001$). Both factors explained in total 54% variance of the acceptability of the variable kilometre charge. No moderator effect was found.

4. Conclusion and discussion

In this study, we examined the effect of revenue use and perceived effectiveness of transport pricing on acceptability of transport pricing policies. In line with previous studies, the pricing policies were evaluated as rather unacceptable (e.g., Steg, 2003; Schade & Schlag, 2000). It was hypothesized that transport pricing policies are less acceptable if they are perceived to be unfair and if they restrict people's freedom to move. Therefore, it was expected that pricing policies are more acceptable if revenues are used to decrease car related taxes rather than general taxes. As expected, the flat kilometre charge was evaluated as more acceptable if revenues were returned to the car users rather than to the general public. For the variable kilometre charge, no difference was found in the acceptability of the measure if revenues were returned to the car user rather than to the general public. Also, acceptability of the variable kilometre charge appeared not to be dependent on revenue use when controlled for actual changes in travel costs.

Economic theory proposes to distribute revenues in a way that brings maximum benefits or highest welfare to society in general. From that perspective, decreasing general taxes excels reducing car related taxes, since the former will result in a neutral net financial effect for all people (Ubbels & Verhoef, 2002; Verhoef et al., 2004), i.e., high as well as low income groups will generally profit if revenues are used to decrease income taxes (Verhoef & Rietveld, 2001). Using revenues to decrease fixed taxes for car users, i.e., road taxes or taxes on the purchase of cars, will result in a positive effect on most people, but results in negative welfare effects for low incomes. The results of this study show that car users have different preferences for using revenues. Car users find investing revenues of pricing policies to decrease income taxes less acceptable than using revenues to decrease car related taxes.

In line with former studies, in general, people expect little or no effects of kilometre charges on collective problems resulting from car use as well as on their own situation. The acceptability of both the flat and variable kilometre charges appeared to be related to relationship between perceived effects of these measures on collective problems as well as to perceived effects on one's own situation. This implies that people evaluate transport pricing measures as more acceptable if the measures actually reduce collective problems resulting from car use and if the measures do not seriously affect their own behaviour. And the other way around: the kilometre charges are less acceptable if they are not effective in reducing collective problems and if they do affect one's own behaviour. Thus, transport policies are more acceptable if they actually reduce the problems caused by car use, without significantly affecting one's own behaviour.

The relationship between perceived effects of the kilometre charges on collective problems and acceptability of the measures was not moderated by the perceived effect of the measures on one's own situation. This implies that the relationship between effects on collective problems and acceptability is not dependent on the effects one's own behaviour, i.e., we did not find any evidence that a relationship between effects on collective problems and acceptability can only be found if a transport pricing measure does not seriously affect one's own behaviour.

Interestingly, the perceived effects of the kilometre charges relates more strongly to the expected effects of the kilometre charge on collective problems than on actual changes in individual travel costs. This indicates that the overall effects of transport pricing policies for oneself are not only (and mainly) dependent on the extent to

which individual travel costs reduce or increase. Apparently, other factors, such as perceived effects on collective problems, are more important in this respect. This suggests that people may be better off if collective problems, such as congestion and environmental problems, reduce. The results of this study indicate that acceptability of transport pricing strategies is more strongly related to the extent to which these policies may reduce collective problems than to the financial consequences for oneself.

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Appendix

Table 4. Assessment o f decrease of road taxes (in euros) based on fuel type and weight of the car

Weight/ fuel	Petrol	Diesel	LPG
Light (<1000 kg)	220	550	500
Middle (1000-1250 kg)	350	700	700
Heavy (>1250 kg)	550	1100	1100

Table 5. Assessment of decrease of taxes on purchase of cars (in euros) based on fuel type and weight of the car

Weight/fuel	Petrol	Diesel	LPG
Light (<1000 kg)	300	600	300
Middle (1000-1250 kg)	500	700	500
Heavy (>1250 kg)	650	900	650